

**WHAT IS CLAIMED IS:**

1. A stem cell expansion factor, which comprises an amino acid sequence having the expansion enhancement activity of a peptide encoded by a Hox nucleotide sequence enhancing expansion of a stem cell population, and wherein said amino acid sequence is able to cross a cell membrane.
2. The factor according to claim 1, wherein said amino acid sequence is a HOXB4 or HOXA4 protein.
3. The factor according to claim 1, wherein said amino acid sequence further comprises an HIV-derived peptide able to cross a cell membrane.
4. The factor according to claim 3, wherein said HIV-derived peptide consists of a NH<sub>2</sub>-terminal protein transduction domain (PTD) from a transactivating protein (TAT).
5. The factor according to claim 4, wherein said stem cell is a hematopoietic stem cell.
6. The factor according to claim 5, wherein said hematopoietic stem cell is human or mouse.
7. A method for enhancing expansion of a stem cell population, the method comprising directly delivering in a stem cell population an effective amount of the stem cell expansion factor of claim 1, whereby said amino acid sequence is able to cross a cell membrane and is substantially active in said stem cell

population, thereby enhancing expansion of said stem cell population.

8. A method according to claim 7, wherein said amino acid sequence is a HOXB4 or HOXA4 protein.

9. A method according to claim 7, wherein the amino acid sequence is delivered in said stem cell population *in vivo*.

10. A method according to claim 7, wherein said amino acid sequence further comprises an HIV-derived peptide able to cross a cell membrane.

11. A method according to claim 10, wherein said HIV-derived peptide consists of a NH<sub>2</sub>-terminal protein transduction domain (PTD) from a transactivating protein (TAT).

12. A method according to claim 11, wherein said stem cell is a hematopoietic stem cell.

13. A method according to claim 12, wherein said hematopoietic stem cell is human.

14. A drug-inducible method for enhancing expansion of a stem cell population, the method comprising:

a) delivering in a stem cell population a nucleotide sequence linked to a drug-binding protein and encoding one of a DNA-binding domain and a NH<sub>2</sub>-terminal domain of a peptide having the activity of a Hox protein able to enhance expansion of said stem cell population, delivering in said stem cell population a

nucleotide sequence encoding the remainder of the DNA-binding domain and N-terminal domains linked to a drug-binding protein; and

b) exposing said stem cell to a dimerizing agent; whereby a functionally active protein is reconstituted in said stem cell population, thereby enhancing expansion of said stem cell.

15. A method according to claim 14, wherein said drug-binding protein consists of FKBP12, and wherein said dimerizing agent consists of FK1012 or an analog thereof.

16. A method according to claim 15, wherein said stem cell is a hematopoietic stem cell.

17. A method according to claim 16, wherein said hematopoietic stem cell is human.

18. A method for restoring a patient hematopoietic capability, said method comprising directly delivering in a hematopoietic stem cell population of a patient the stem cell expansion factor of claim 1, wherein said amino acid sequence is able to cross a cell membrane and is substantially active in said hematopoietic stem cell, thereby enhancing expansion of said hematopoietic stem cell population and restoring hematopoietic capability of said patient.

19. A method according to claim 18, wherein said amino acid sequence is a HOXB4 or HOXA4 peptide.

20. A method according to claim 18, wherein said amino acid sequence is delivered in said hematopoietic stem cell *in vivo*.

21. A method according to claim 18, wherein said amino acid sequence further comprises an HIV-derived peptide able to cross a cell membrane.

22. A method according to claim 21, wherein said HIV-derived peptide consists of a NH<sub>2</sub>-terminal protein transduction domain (PTD) from a transactivating protein (TAT).

23. A method according to claim 19, wherein said hematopoietic stem cell is human.

24. A composition comprising a hematopoietic stem cell population having enhanced expansion capability, said hematopoietic stem cell population being generated by directly delivering therein the stem cell expansion factor of claim 1 and which is functionally active therein, in association with a pharmaceutically acceptable carrier.

25. The factor according to claim 1, wherein said amino acid sequence is a HOXC4 or HOXD4 protein.